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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/884,670	06/19/2001	Stephen R. Fox	YOR920010104(14270)	4482

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Steven Fischman Esq.
Scully Scott Murphy and Presser
400 Garden City Plaza
Garde City, NY 11530

EXAMINER	
POMPEY, RON EVERETT	
ART UNIT	**PAPER NUMBER**
2812	

DATE MAILED: 12/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/884,670	FOX ET AL.
	Examiner	Art Unit
	Ron E. Pompey	2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 27 September 2005.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,3-22,25-36,40,48,49,51 and 52 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1, 3-22, 25-36, 40 and 48, 49 and 51-52 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 6-19-01
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-22, 25-36, 40 and 48, 49 and 51-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sadana et al. (US 6,090,689) in further view of Tachimori et al. (US 5,534,446), Sadana et al. (US 5,930,643) and/or admitted prior art.

Sadana ('689) discloses the steps of:

For claims 1, 3-22, 25-36, 40 and 48, 49 and 51-52:

implanting oxygen ions (14, 18, fig. 2) into a surface of a Si-containing substrate, said implanted oxygen ions having a concentration sufficient to form a buried oxide region during a subsequent annealing step (note: tiles and divots will inherently form due to implantation of oxygen in the Si containing substrate and the size and number, respectively will be determined by the preceding annealing); and

annealing said substrate containing said implanted oxygen ions in an ambient gas that comprises about 0 to about 90% oxygen at a temperature of about 1250^{o}C or greater with a inert mixture (col.4, lns. 32-33; the examiner is taking that all post implant anneals will include a mixture of inert gas and oxygen) to form said buried oxide region which electrically isolates a superficial Si-containing layer from a bottom Si-containing layer, wherein said annealing is carried out until tile or divot defects present at a top

surface of said superficial Si-containing layer are reduced in terms of tile enlargement and divot number reduction, respectively thereby permitting for optical detection of other defects that have a lower density than said tile or divot defects (22, fig. 3)(note: because an inert/oxygen gas mixture is used under the condition claimed the result will produce reduction of tile enlargement and divots);

wherein said second oxygen implant step is carried out using an oxygen dose of from about 1E14 to about 1E16 cm^{-2} and at an energy of about 40 keV or greater;

wherein said second oxygen implant step is carried out using an oxygen dose of from about 1E15 to about 4E15 cm^{-2} and at an energy of from about 120 to about 450 keV;

wherein said second oxygen implant step is carried out at a temperature of from about 4K to about 200^{O}C at a beam current density of from about 0.05 to about 10 mA cm-2;

wherein said base oxygen implant comprises a high-dose oxygen implant, which is carried out using an oxygen dose of about 4E17 cm^{-2} or greater;

wherein said high-dose oxygen implant is performed using an oxygen dose of from about 4E17 to about 4E18 cm^{-2} ;

wherein said high-dose oxygen implant is carried out at energy of from about 10 to about 1000 keV;

wherein said high-dose oxygen implant is carried out at energy of from about 120 to about 210 keV;

wherein said high-dose oxygen implant is carried out at a temperature of from about 200^{O} to about $800^{O}C$ at a beam current density of from about 0.05 to about 500 mA cm^{-2} ;

wherein said base oxygen implant comprises a high-energy, high-dose oxygen implant which is carried out using an oxygen ion dose of about 4E17 cm^{-2} or greater and at an energy of about 60 keV or greater;

wherein said high-energy, high-dose oxygen implant is carried out using an oxygen ion dose of from about 5E17 to about 7E17 cm^{-2} and at energy of from about 200 to about 500 keV;

wherein said high-energy, high-dose oxygen implant is performed at a temperature of from about 100^{O} to about $800^{O}C$ at a beam current density of from about 0.05 to about 500 mA cm^{-2};

wherein said high-energy, high-dose oxygen implant is performed at a temperature of from about 300^{O} to about $700^{O}C$;

wherein said base oxygen implant comprises a low-dose oxygen implant which is carried out using an oxygen dose of about 4E17 cm^{-2} or less;

wherein said low-dose oxygen implant is performed using an oxygen dose of from about 1E17 to about 3.9E17 cm^{-2};

wherein said low-dose oxygen implant is carried out at energy of from about 20 to about 10000 keV

wherein said low-dose oxygen implant is carried out at energy of from about 100 to about 210 keV;

wherein said low-dose oxygen implant is carried out at a temperature of from about 100^{o} to about $800^{o}C$;

wherein said low-dose oxygen implant is carried out at a temperature of from about 200^{o} to about $650^{o}C$ at a beam current density of from about 0.05 to about 500 mA cm^{-2};

wherein said annealing step is carried out for a time period of from about 1 to about 100 hours;

wherein said annealing step is carried out at a temperature of from about 1300^{o} to about $1350^{o}C$ for a time period of from about 2 to about 24 hours;

further comprising applying a patterned resist to the surface of the SOI wafer prior to oxygen implantation (col. 3, lns. 6-12 and col. 4, ln. 8 – col. 6, ln. 8);

said second oxygen implant is omitted(col. 1, lns. 22 -59).

3. Sadana ('689) discloses the claimed invention except for:

superficial Si-containing layer having a thickness form about 100 to about 2000Å;

annealing said substrate containing said implanted oxygen ions in an ambient gas that comprises from about 10 to about 100% of N2;

optically detecting said other defects;

wherein second oxygen implant step has a beam current density that is from about 0.5 to about 5.0 mA cm^{-2};

wherein base oxygen implant step has a beam current density that is from about 4 to about 8 mA cm^{-2};

wherein said ambient gas comprises 100% N_2;

wherein said ambient gas is admixed with Ar;

wherein said partially annealing is carried out in an ambient that comprises from about 1 to about 100% oxygen and from about 0 to about 99% inert gas;

wherein the annealing step is carried out in an ambient gas comprising at least one high-surface mobility/inert gas is selected from the group consisting of He, Kr, Ar, H_2 and mixtures thereof;

wherein said annealing step includes a ramp and soak-heating regime;

wherein the annealing step comprises the steps of: partially annealing the substrate so as to form a surface layer of oxygen on the substrate; stripping the surface layer of oxygen; and continuing the annealing to complete the formation of said BOX region;

wherein said partially annealing is carried out in an ambient that comprises from about 1 to about 100% oxygen and from about 0 to about 99% inert gas;

wherein said partial annealing is performed at a temperature of from about 1250^{O} to about 1400^{O}C for a time period of from about 1 to about 100 hours;

wherein said partial annealing is performed at a temperature of from about 1320^{O} to about 1350^{O}C for a time period of from about 2 to about 20 hours; and

wherein said surface layer of oxygen is removed utilizing a wet etch process that includes an etchant that has a high- selectivity for removing oxide compared with Si.

a. However, Sadana('643) discloses the limitations of:

the ambient/inert gases, temperatures and times during annealing;

the ambient/inert gases, temperatures and times during partially annealing of the substrate containing said implanted oxygen ions and forming a surface layer of oxygen on the substrate; stripping the surface layer of oxygen; and continuing the annealing to complete the formation of said BOX region; and

ramp and soak heating regime (col. 5, lns. 15-62).

Therefore it would have been obvious to those of ordinary skill in the art to combine Sadana('689) with Sadana ('643) because, the ambient/inert conditions will prevent the semiconductor surface from roughening and that the oxide is of poor quality and needs to be removed before forming a device on the SOI substrate.

b. Also the Sadana ('689 and '643) and admitted prior art (see page 3, lines 1-4) disclose is it well known in the art to form a superficial Si-containing layer having a thickness form about 100 to about 2000Å and use an optical inspection tool to inspect process induced features or defects, respectively. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the superficial Si layer to the desired thickness due to the fact that implantation allows you the precisely implant ions to a desired depth and the superficial layer is formed by the implantation of the oxygen ions; and use a beam current at the range disclosed to form the buried oxide region at a controlled distance, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Response to Arguments

4. Applicant's arguments filed 9-27-05 pertaining to claims 1, 3-22, 25-36, 40 and 48, 49 and 51-52, have been fully considered but they are not persuasive. The applicant argues that "...none of the prior art methods teach or suggest a method in which a steps of annealing a substrate containing the implanted oxygen ions in an ambient gas that comprises from about 0 to about 90% oxygen and from about 10 to about 100% of N_2 at a temperature of about 1250^{0}C or greater to form a buried oxide region which electrically isolates a superficial Si-containing layer having a thickness from about 100 to about 2000 Å from a bottom Si-containing layer, wherein said annealing is carried out until tile or divot defects present at a top surface of said superficial Si-containing layer have a first density that does not obstruct detection of other defects that have a second density that is lower than said first density; and the optically detecting the other defects.

First, the applicant appears to be saying, as what is disclosed in the specification, that the annealing steps, including the gas atmosphere during annealing, used after the second oxygen implantation will allow optical detection of the other defects that have a second, lower, density than the divot or tile defects density. The prior art reads on the **claimed** parameters used to anneal after a dual oxygen-implant into a substrate therefore because **the process steps are the same, the results achieved will be the same** as applicants **claimed** invention.

Second, the examiner is viewing the implantation of the oxygen steps as one of the causes of the tile, divot and other defects into the surface of the superficial Si-containing layer. Therefore, whether stated or not these defects are present. Also, the

fact that Applicant uses the annealing for a different purpose does not alter the conclusion that its use in a prior art device would be prima facie obvious from the purpose disclosed in the reference." In re Lintner, 173 USPQ 560.

Third, the inherency is proper because the steps taken, implanting oxygen and then annealing the substrate containing the implanted oxygen ions, in the combination of the prior arts are performed under the same conditions claimed, therefore should give the same result of tile enlargement and divot reduction as applicants invention. If the recipe is not inherent than applicants' invention does not work in all the time under these conditions.

Also, the applicant states that Sadana('689) does not disclose a second implantation step. However, in column 4, lines 51-54, there is a disclosure of a second implantation before an annealing of the substrate.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ron E. Pompey whose telephone number is (571) 272-1680. The examiner can normally be reached on compressed.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ron Pompey
Ron Pompey
AU: 2812
December 26, 2005

MICHAEL LEBENTRITT
SUPERVISORY PATENT EXAMINER